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ANTHROPOLOGY.—*Two proto-Algonquian phonetic shifts.* TRUMAN MICHELSON, Bureau of American Ethnology.[1]

The following paper will eventually appear in elaborated form in the *International Journal of American Linguistics*, so that this presentation is to be regarded as an abstract. Hence it is that the proofs are given concisely, and certain unimportant details are passed over.

Some years ago[2] I pointed out that in Fox the interchange of *-aw-* and *-ō-* was of regular occurrence. At the time it escaped me that *-aw-* and *-ā-* also interchanged; and that whether *-ō-* or *-ā-* interchanged with *-aw-* was dependent on the particular consonants that immediately followed. Examples are: *ă'wāpiwītA'mawād^{tc}'* "then he began telling them," *kewītAmōn^{ne}'* "I tell thee," *nī'wītAmāg^{kwA}'* "he will tell me," *neme'tciwītAmā'gunān^{na}'* "he told us (excl.) plainly;" *pe'se'tawin^{nw}'* "listen thou to me," *kī'pe''setōn^{ne}* "I shall listen to thee," *nī'pe'setāg^{kwA}'* "he will listen to me;" *ă'tōta'wiyAn^{ni}'* "the way you (sing.) treated me," *ă'tō'tōnān^{ni}'* "the way I treated you (sing.)," *ă'tō'tāgu^{d}tc^{i}'* "the way he was treated by;" *ă'pōnine''kawād^{tc}i'* "then he ceased pursuing them," *kī'pemi'ne'kōn^{ne}'* "I shall pursue thee," *pemine''kā'sō^{wA}'* "he was pursued," A'cā'A*ni pemi'ne'kāg^{kwA}'* "he was pursued by the Sioux;" *kene'ckina'wipen^{na}'* "you hate us," *kene'ckinō'n^{ne}'* "I hate thee," *kene'ckināgō'g^{ki}'* "they hate thee;" *kī'pyătawip^{wA}'* "you will bring it to me," *kepyătōnep^{wA}'* "I bring it to you," *ă'pyătō^{d}tc^{i}'* "when he brings it," *pyătōt^{e}'* "if he brings it," *kī'pyătāgōg^{ki}'* "they will bring it to thee;"

[1] Printed with permission of the Secretary of the Smithsonian Institution.

[2] This JOURNAL 4: 403, 404. 1914.

keneno'tawi "dost thou understand me," *awita neno'tō'nAgu's*^{a} "he might not understand us (incl.)," *keneno'tōn*^{nc} "I understand thee," *keneno'tāg*^{kwA} "he understands thee;" *keneno'tātīpen*^{na} "we (incl.) understand each other;" *ā'mānō'kawu*^{d}*tc*^{i} "then many attacked him" [really an independent passive in formation], *ā'mānō'kāgu*^{d}*tc*^{i} "then he was attacked by many;" *keteminawāt*^{c} "if he takes pity on him," *keteminawi* "take pity on him," *keteminō'nago*^{wc} "I take pity on you," *keteminō'k*^{i} "he takes pity on thee," *nenī'cwiketeminā'gōpen*^{na} "we (excl.) are both pitied." From the above it follows that *-aw-* appears as *-ō-* before *-n-*, *-t-*, [in final syllables], *-*^{d}*tc-*, *-'k-*; as *-ā-* before *-g-*, *-t-* [normally], *-'s-*. I have evidence to show that *-aw-* also has the same shifts before the same consonants (or their phonetic correspondents) in Cree, Sauk, Kickapoo, Shawnee, Ojibwa, Potawatomi, Ottawa, Algonkin, Peoria, Delaware, Penobscot, and Passamoquoddy. Hence it is quite certain that these shifts took place in the Algonquian parent language. I call attention to the fact that this is the first time in the history of American linguistics that phonetic shifts in the parent language of any American linguistic stock have been pointed out.

I have previously shown that *n* (or its phonetic equivalent) changes to *c* (or its phonetic equivalent) before *i* which is the initial sound of a new morphological unit in Sauk, Fox, Kickapoo, Shawnee, Menomini, Ojibwa, Algonkin, and Peoria. The change of *s* to *c* under the same conditions occurs in Sauk, Fox, Kickapoo, and Ojibwa. The interchange of *ā* and *ā* is found in Sauk, Fox, Kickapoo, Shawnee, and Peoria. Further researches may show that these shifts occur in other Algonquian languages also, and so perhaps may likewise be referred to the Algonquian parent language. The contraction of *-wA-* to *-ō-* occurs in a number of Algonquian languages, but the evidence of Cree is unfavorable to the theory that this particular shift is to be ascribed to the Algonquian parent language. As the shift occurs in languages which are geographically all contiguous it is possible the shift has simply spread, so as to be practically pan-Algonquian rather than proto-Algonquian.[3]

[3] See this JOURNAL 4: 402. 1914; Amer. Anthropol. n. ser. 15: 470. 1913; Internat. Journ. Amer. Ling. 1: 50. 1917.

RADIOTELEGRAPHY.—*Quantitative experiments with coil antennas in radiotelegraphy.* L. W. AUSTIN, U. S. Naval Radio Laboratory.

The use of large inductance coils for sending, receiving, and direction determination was first proposed by the late Professor Braun,[1] who carried out experiments at Strassburg on signals from the Eiffel Tower and gave the general theory of a coil used as an antenna.[2]

Received current measurements, such as the laboratory made some years ago for the verification of the theory of transmission between ordinary antennas, have now been made for closed coils. According to the theory, a rectangular vertical coil of N turns, height H and length L, is equivalent to two vertical antennas of effective height NH at a distance apart L, with their respective currents in opposite phase. Taking into account the phase difference due to the difference in path, either in sending to a point p, or in receiving from p, the effect will be the same as that of one antenna of height NH multiplied by the phase difference $2\pi \frac{L}{\lambda} \cos\theta$ where θ is the angle between the plane of the coil and the direction of p.[3]

Now, the expression for the received current in a receiving antenna, with an antenna sending sustained waves, is, disregarding absorption:[4]

$$I_r = 120\pi \frac{I_s h_s h_r}{\lambda d R} \qquad (1)$$

where I_s is the sending antenna current, h_s the effective height of the sending antenna, h_r that of the receiving antenna, λ the wave length, d the distance, and R the receiving antenna resistance, expressed in amperes, ohms, and meters. If either or both of the antennas is replaced by a coil, we must replace its

[1] BRAUN, F. Jahrb. Draht. Telegr. 8: 1–132. 1914.

[2] Mr. KOLSTER, of the Bureau of Standards, has developed an excellent direction finder on this principle.

[3] ZENNECK. Wireless Telegraphy. 1915. p. 234 and note 307, p. 425.

[4] ZENNECK. Wireless Telegraphy. 1915. p. 248; Bur. Stand. Bull. 11: 70. 1914.

height by $NH2\pi \frac{L}{\lambda} \cos\theta$ where NH is the height of the coil times the number of turns, and we find for a

Coil Sending and Antenna Receiving

$$I_r = 120\pi \frac{I_s N_s H_s}{\lambda d} 2\pi \frac{Ls}{\lambda} \cos\theta_s \frac{h_r}{R}$$

$$= 2369 \frac{I_s N_s H_s L_s h_r}{\lambda^2 dR} \cos\theta_s \qquad (2)$$

In the same way for an

Antenna Sending and Coil Receiving

$$I_r = 2369 \frac{I_s h_s N_r H_r L_r}{\lambda^2 dR} \cos\theta_r \qquad (3)$$

and for

Coil Sending and Coil Receiving[5]

$$I_r = 14880 \frac{I_s N_s H_s L_s N_r H_r L_r}{\lambda^3 dR} \cos\theta_s \cos\theta_r. \qquad (4)$$

The effective height h of an ordinary antenna equivalent to any coil NH may be expressed if $\theta = o$, by

$$h = 2\pi \frac{NHL}{\lambda} = 2\pi \frac{\text{area} \times \text{turns}}{\lambda}. \qquad (5)$$

The equations show that, other things being equal, if an antenna be used, both for sending and receiving, the received current falls off as the wave length, while if one coil be used, it falls off as the square of the wave length, and with two coils as the cube of the wave length.

The value of the constant in the equation for a sending coil requires some consideration. The value given assumes that as the radiated field grounds itself, it takes the form of a field formed by the coil and its image as in the case of an antenna. This is probably true, at least for a coil whose dimensions are large compared with its distance from the ground. In the case of reception, this question does not enter.

[5] Dr. DELLINGER, of the Bureau of Standards, has published coil formulas in practical units with slightly different constants in a confidential report for the Signal Corps, Radio Transmission Formulas, July 1917.

Signals from Arlington have been measured at the laboratory on two coils. One was a crossed coil direction finder mounted on the roof of one of the buildings, having 56 closely wound turns, a height of 1.82 meters and a length measured between the planes of the front and back vertical sections of 1.29 meters. The second coil supported from masts, had 7 turns 80 cm. apart and measured 21.6 × 24.4 meters, θ being 42°. The results are shown in tables 1 and 2.

TABLE 1

ARLINGTON ARC RECEIVED AT LABORATORY ON DIRECTION FINDER

λ Meters	Received Current Amp. Observed	Calculated	Difference	Per cent Difference
6000	$208.0 \cdot 10^{-6}$	$157.5 \cdot 10^{-6}$	50.5	24
7500	$128.1 \cdot 10^{-6}$	100.8	27.3	21
10000	$67.5 \cdot 10^{-6}$	56.7	10.8	16
I_s = 100 amp.	N = 56	L = 1.29 m.	θ = 0°	
h_s = 71 m.	H = 1.82 m.	R = 50 ohms	d = 7800 m.	

TABLE 2

ARLINGTON ARC RECEIVED AT LABORATORY ON LARGE COIL

λ Meters	Received Current Amp. Observed	Calculated	Difference	Per cent Difference
4000	$8.78 \cdot 10^{-3}$	$7.38 \cdot 10^{-3}$	1.40	16
6000	3.71	3.28	0.43	12
7500	2.26	2.10	0.16	7
10000	1.23	1.18	0.05	4
I_s = 100 amp.	N = 7	L = 24.4 m.	θ = 42°	
h_s = 71 m.	H = 21.6 m.	R = 50 ohms	d = 7800 m.	

TABLE 3

LARGE COIL AT LABORATORY RECEIVED ON ANTENNA AT ARLINGTON

λ Meters	Received Current Amp. Observed	Calculated	Difference	Per cent Difference
2800	$147.8 \cdot 10^{-6}$	$150.8 \cdot 10^{-6}$	—3.0	2
4890	50.5	49.5	1.0	2
I_s = 1 amp.	N = 7	L = 24.4 m.	θ = 42°	
h_r = 71 m.	H = 21.6 m.	R = 50 ohms	d = 7800 m.	

Table 3 shows the current received on the antenna at Arlington from the large coil at the laboratory excited by a coupled-

bulb circuit. The received currents in all three cases were measured with shunted detectors and galvanometers,[6] calibrated and tested for proportionality between deflection and current squared in each experiment.

In each of the tables, for the sake of comparison, the results are reduced to a common value of sending current and a common receiving resistance.

The observed values in tables 1 and 2 are seen to be uniformly larger than the calculated. This is supposed to be due to an action of the coil as an antenna since an increase in the length of

TABLE 4

COMPARISON OF ANTENNAS AND COILS

λ (Meters)	Equivalent Effective Antenna Height (Meters)				
	10	20	30	40	50
	Coil Area × Turns (Meters)				
200	319	637	956	....	....
500	796	1592	2388	3184	3980
1000	1592	3184	4776	6370	7960
2000	3185	6370	9552	12740	15920
3000	4776	9552	14280	19100	23880
5000	7960	15920	23880	31840	39800
7000	11140	22280	33450	44580	55760
10000	15920	31840	47760	63700	79600
12000	19110	38220	57330	76440	95520
15000	23880	47760	71640	95520	119400
20000	31840	63780	95520	127400	159200

the leads increases this difference. When the lower side of the coil is on or close to the ground, there is also an effect due to radio frequency earth currents just as in the case of the ground antenna. The reason for the increased error at the shorter wave lenghts is not yet clear. The agreement of observed and calculated values in the case of the coil sending (table 3) is all that could be desired. From this, sending from a coil and re-

[6] This JOURNAL 8: 569. 1918.

ceiving on an antenna, seems to offer the most accurate method for determining antenna effective height.[7]

Table 4 gives the effective heights of antennas which are equivalent either for sending or receiving to coils of various area turns, calculated from equation 5.

The observations in this paper have been taken for the most part by W. E. Grimes, Chief Electrician (Radio), assistant in the laboratory.

[7] In experiments of this kind incorrect results may be obtained, if observations are made too near the natural wave length of the coil, as in the case the current distribution is no longer uniform on account of the effect of the distributed capacity.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. The abstracts should conform in length and general style to those appearing in this issue.

ANTHROPOLOGY.—*Seneca fiction, legends, and myths.* Collected by JEREMIAH CURTIN and J. N. B. HEWITT. Paper accompanying the 32d Annual Report of the Bureau of American Ethnology. Pp. 36–83. 1918.

This paper consists of 58 stories classified as "fiction," 21 legends, 14 traditions, 4 tales, 9 myths, and 1 note on native medicine collected from the Seneca Indians on the Cattaragus reservation in 1883, 1886, and 1887 by the late Jeremiah Curtin; 31 legends and myths of much greater average length obtained by Mr. J. N. B. Hewitt of the Bureau of American Ethnology in the autumn of 1896, the last three accompanied by native Seneca texts; 23 pages of notes; and a short but important interpretative introduction of 29 pages. In this last Mr. Hewitt gives a history of the Seneca tribe, describes and explains the material in general terms, laying stress upon the importance of distinguishing true myths and legends from popular and even indecent tales not confined by any means to primitive peoples; attempts and outline of Mr. Curtin's views regarding primitive mythology; and concludes with a short but interesting exposition of his own opinions upon that subject.

J. R. SWANTON.

ELECTRICITY.—*Electrical characteristics and testing of dry cells.* Bur. Stand. Circ. No. 79. Pp. 44. 1919.

This circular summarizes the available information on dry cells. A brief description of the materials and methods of construction, and elementary theory of the operation of the cells is given. The various sizes and kinds of dry cells on the American market are described. The electrical characteristics of the cells and methods of testing them are discussed. In an appendix are given the proposed specifications for dry cells which have been prepared by the Bureau.

G. W. VINAL.

METALLURGY.—*Conservation of tin in bearing metals, bronzes, and solders.* G. K. BURGESS and R. W. WOODWARD. Bur. Stand. Tech. Paper No. 109. Pp. 9. 1918.

This paper gives practical suggestions for the conservation of tin in bearing metals, bronzes, and solders; much of the data having been obtained from questionnaires sent to representative manufacturers and users of the above named alloys. Tables are given showing the chemical composition and physical properties of many of the suggested alloys and also for service tests of genuine babbitt and a high lead bearing metal. Tentative recommendations for standard grades of bearing metal are also included.

Proper solders for various industrial uses are recommended and a new solder consisting of a preponderance of lead with small amounts of tin and cadmium is described. R. W. W.

PHYSICS.—*Preliminary determination of the thermal expansion of molybdenum.* LLOYD W. SCHAD and PETER HIDNERT. Bur. Stand. Sci. Paper No. 332. Pp. 9. 1919.

The thermal expansion of an exceptionally pure specimen of molybdenum (99.85 per cent) was determined from —142° to +305° C. A short description of the apparatus and of the method used in obtaining high and low temperatures is given.

The results are shown in the form of tables, from which were computed, by the method of least squares, the following two empirical equations which satisfy the observations:

$L_t = L_0(1 + 5.15\ t \times 10^{-6} + 0.00570\ t^2 \times 10^{-6})$ and
$L_t = L_0(1 + 5.01\ t \times 10^{-6} + 0.00138\ t^2 \times 10^{-6})$

where L_t is the length of the specimen at any temperature t within the proper range; in the first case +39° to —142° C, and in the second case +19° to +305° C. The probable error of the length computed from these equations is less than 3×10^{-6} per unit length. P. H.

OPTICS.—*Optical conditions accompanying the striae which appear as imperfections in optical glass.* A. A. MICHELSON. Bur. Stand. Sci. Paper No. 333. Pp. 5. 1919.

Striae are conveniently divided into two classes; first those which appear as isolated bright streaks; second, those in which such streaks are numerous, forming bright irregularly continuous bands. Optical investigation with two forms of interferometers show that the former

are due to laminae of smaller index and of thickness of the order of a hundredth of a millimeter. They do not seriously affect the optical qualities of lenses or prisms. The second class of striae in general does not affect the optical performance; but, in the case of lenses and plane parallel plates, etc., in which the light traverses the striae at approximately normal incidence, the performance may be quite as good as with a perfect specimen. A. A. M.

TECHNOLOGY.—*The table of unit displacement of commodities.* Bur. Stand. Circ. No. 77. Pp. 67. 1919.

This circular showing (1) the number of pounds per cubic foot as packed for shipment, (2) the number of cubic feet of space required for a short ton, (3) the number of cubic feet of space required for a long ton, and (4) the manner in which the material is packed, lists several hundred commercial commodities alphabetically. Appendixes give special information concerning automobiles, canned fruits and vegetables, and fresh fruits and vegetables.

This table has been prepared to meet an immediate demand for such information and will be revised and augmented from time to time as further data are obtained. The Bureau will, therefore, be pleased to receive information, criticisms, and suggestions from those interested in the table. H. M. Roeser.

TECHNOLOGY.—*Solders for aluminum.* Bur. Stand. Circ. No. 78. Pp. 9, pls. 2. 1919.

The use, serviceability, method of application, and composition of solders for aluminum are discussed in the light of special tests made at the Bureau of Standards on commercial and other compositions of solders. All soldered joints are subject to rapid corrosion and disintegration and are not recommended except where protection from corrosion is provided. Suitable compositions for solders are obtained by the use of tin with the addition of zinc or both zinc and aluminum within wide percentage limits. Solders are best applied without a flux. The higher the temperature at which the "tinning" is done, the better the adhesion of the tinned layer. A perfect union between solder and aluminum is very difficult to obtain, but the joint between previously tinned surfaces may be made by ordinary methods and with ordinary soft solder. Only the tinning mixture need be special. Tables of the composition of many solders are given. J. F. Meyer.

TECHNOLOGY.—*Tests of hollow building tiles.* BERNARD D. HATHCOCK and EDWARD SKILLMAN. Bur. Stand. Tech. Paper No. 120. Pp. 29. 1919.

These tests were made upon the types and sizes of tiles most commonly used in practice, and were carried out with the idea of studying their strengths and the relations existing between their various properties, especially those introduced by the kinds of clays used, the method of manufacture, and the positions in which they are laid. The principal tests discussed are those of compression and absorption which together total approximately 250. Strain readings were taken upon some with an 8-inch Berry strain gage for moduli determinations. The testing machines used were of the Olsen Universal type.

The results obtained show the loads at incipient failures, the maximum compressive strengths, and the moduli of elasticity of the various types and size of the tiles tested on end, on edge, and flat. Relationships are established between the moduli of elasticity and the compressive strengths, the colors of the tiles and their compressive strengths, the colors of the tiles and their moduli of elasticity, the percentages of absorption and the compressive strengths, and the percentages of absorption and the colors of the tiles. B. D. H.

MAMMALOGY.—*East African mammals in the United States National Museum.* Part 2. Rodentia, Lagomorpha, and Tubulidentata. N. HOLLISTER. U. S. Nat. Mus. Bull. 99, part 2. Pp. i–x, 1–184, pls. 1–44, fig. 1. May 16, 1919.

This second volume of a report on the mammals from Eastern Equatorial Africa contained in the collections of the National Museum lists 4,863 specimens of rodents, hares, and aardvarks, all but 100 of which were collected by the Smithsonian African Expedition, under the direction of the late Col. Theodore Roosevelt, 1909–10, and by the Paul J. Rainey African Expedition, 1911–12. The richness of the National Museum collection of East African mammals is well illustrated by the fact that in the two parts of this work so far published, dealing only with six orders of mammals, are listed 6,696 specimens, including 142 types; representing 349 valid species and subspecies. The plan of arrangement of the text adopted in the first volume has been followed throughout, and the geographical limits are the same. A list of all localities with index references to an accompanying map; generic and specific synonymies; type localities and location of type specimens; critical notes on distribution, habits, nomenclature, and taxonomy; lists of stations where each form was collected; and full tables of measurements of specimens are included. The skulls of all type specimens are figured natural size. It is hoped that a third volume, containing reports on the primates and the several orders of ungulate mammals, may complete the series. N. H.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

WASHINGTON ACADEMY OF SCIENCES.

The 127th meeting of the Academy was held in the Assembly Hall of the Interior Department the evening of Friday, June 7, 1918, the occasion being an address by Professor WILLIAM S. FRANKLIN, of the Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts, entitled *Some needed lines of research in meteorology*. This address, which was informally discussed by Messrs. C. F. MARVIN and W. J. HUMPHREYS, has since been published in the Monthly Weather Review for October, 1918 (**46:** 449–453. 1919), under the title, *A much needed change of emphasis in meteorological research.*

The 128th meeting of the Academy was held jointly with the Chemical Society of Washington at the Administration Building of the Carnegie Institution of Washington, the evening of Thursday, January 9, 1919. Dr. F. B. POWER, retiring President of the Chemical Society, delivered an illustrated address on *The distribution and character of some of the odorous principles of plants.* This lecture has subsequently been published in the Journal of Industrial and Engineering Chemistry (**11:** 344–352. April, 1919).

The 129th meeting of the Academy, the twenty-first Annual Meeting, was held at the Administration Building of the Carnegie Institution of Washington, the evening of Tuesday, January 14, 1919, with President LYMAN J. BRIGGS in the chair. The minutes of the last annual meeting were read and approved.

The Corresponding Secretary, Dr. R. B. SOSMAN, reported that the membership on January 1, 1919, consisted of 6 honorary members, 4 patrons, and 506 members, one of whom was a life member. The total membership was 516, of whom 315 resided in or near the District of Columbia, 193 in other parts of the United States and in Canada, and 8 in foreign countries. The net gain for the year was 37. During the year the Academy lost by death 8 members: HENRY ADAMS, March 27, 1918; FRANK BAKER, September 30, 1918; GROVE KARL GILBERT, May 1, 1918; JOHN HARPER LONG, June 14, 1918; WILLIAM BATTLE PHILLIPS, June 7, 1918; RICHARD RATHBUN, July 16, 1918; CHARLES RICHARD VAN HISE, November 19, 1918; and HENRY SHALER WILLIAMS, July 31, 1918. The Board of Managers held 12 meetings during the year. The principal matters of general interest acted on by the Board have been reported in the JOURNAL. Among these matters

of general interest was the adoption by the Board of a definite limit of resident membership based upon the scientific population of Washington as recorded in the "Red Book" of the Academy. The membership is limited by this action to twenty per cent of the scientific population, or one in five. This, it is believed, will give additional emphasis to the fact that the Academy recognizes, by election to its membership, original research and scientific or engineering attainment. The Committee on Membership has given a great deal of time and care to the selection of candidates during the past year, and it is fitting that this public acknowledgement should be made of the Academy's indebtedness to that committee.

The Corresponding Secretary's report then reviewed briefly the objects of the Academy, as stated in its articles of incorporation, comparing these objects with the accomplishments of recent years.

The Recording Secretary reported upon the ten public addresses given under the auspices of the Academy during the year, most of which had been published in full in the JOURNAL. The lecture by Professor FRIDTJOF NANSEN, entitled *Changes in oceanic and atmospheric temperatures and their relation to changes in the sun's activity* was published in the JOURNAL as an author's abstract (**8:** 135–138, March 4, 1918).

The Treasurer, Mr. R. L. FARIS, submitted a report covering the last four months of the year, a report for the period from January 1 to August 31, 1918, having been submitted by his predecessor, Major WILLIAM BOWIE. A recapitulation for the year showed total receipts, $6,594.76; total disbursements, $9,168.18, including $2,500.00 expended for Liberty Bonds; cash balance on hand Dec. 31, 1918, $411.39. The Auditing Committee, consisting of Messrs. C. N. FENNER, J. A. FLEMING, and G. N. COLLINS, reported that the statement of the Treasurer was in full agreement with the accounts and with the securities on deposit.

Dr. A. KNOPF read the report of the Board of Editors.

The report of the tellers, Messrs. E. G. ZIES, F. WENNER, and ROBERT B. SOSMAN, was read by the Corresponding Secretary. The tellers reported that the mail ballot had resulted in the election of the following officers for 1919: *President*, F. L. RANSOME; *Corresponding Secretary*, ROBERT B. SOSMAN; *Recording Secretary*, WILLIAM R. MAXON; *Treasurer*, R. L. FARIS; *Non-resident Vice-Presidents*, C. K. LEITH and J. A. BRASHEAR; *Members of Board of Managers, Class of 1922*, C. G. ABBOT and W. F. HILLEBRAND.

The following Resident Vice-Presidents nominated by the affiliated Societies were then elected: *Anthropological Society*, GEORGE M. KOBER; *Archeological Society*, ALEŠ HRDLIČKA; *Biological Society*, HUGH M. SMITH; *Botanical Society*, WALTER T. SWINGLE; *Chemical Society*, ATHERTON SEIDELL; *Electrical Engineers Society*, P. G. AGNEW; *Society of Engineers*, MORRIS HACKER; *Entomological Society*, S. A. ROHWER; *Society of American Foresters*, RAPHAEL ZON; *Geological Society*, F. H. KNOWLTON; *Historical Society*, ALLEN C. CLARK; *Medical*

Society, WILLIAM GERRY MORGAN; *Philosophical Society*, W. J. HUMPHREYS. The National Geographic Society had nominated no Vice-President.

The newly-elected President, Dr. F. L. RANSOME, then took the chair and the retiring President, Dr. LYMAN J. BRIGGS, delivered an address entitled, *The resistance of the air*. This will be published in a later number of the JOURNAL.

The 130th meeting of the Academy was held in the Assembly Hall of the Cosmos Club, the evening of Thursday, January 30, 1919, the occasion being an illustrated lecture by Major F. R. MOULTON, U. S. A., on *The duration of the stars*. Beginning with illustrations showing the principal observatories of the United States and the apparatus by which solar and stellar phenomena have been studied and photographed, the lecturer showed photographs of the moon and of the sun, the one an example of a completely dead world, the other an example of a world which is giving off great quantities of energy and is very far from a state of equilibrium. The source of the sun's energy was discussed and shown to be a result neither of chemical reactions nor of the energy released by the contraction of an aggregate of particles. The latter source would permit the sun a life of at most a few million years, whereas geological and biological evidence demand periods of one hundred million years or more. The source of the sun's energy and its probable life cannot at present be estimated.

After showing diagrams illustrating the relative size of the moon, earth and sun, and the relative size of the orbits of the planets as compared with the distances of the so-called fixed stars, the lecturer passed to a consideration of the probable life of those stars. The problem of the life of star clusters is one that can be dealt with mathematically, and the lecturer calculated the probable period that must have elapsed in order that a more or less heterogeneous collection of stars might, by their mutual gravitation, be brought into the form now found in many of the recognized clusters. In view of the immense distances involved in the dimensions of these clusters, it follows that even a single passage of one star from one side to another of such an aggregate would take a million years; and the total time necessary to form the aggregate as it is now seen must be of the order of several thousand million years.

An interesting digression at this point covered some of the lecturer's work during the war, on the trajectories of projectiles and the best form of projectiles to obtain maximum range. The problems involved in this work were mathematical problems, in many ways similar to the mathematical problems of the astronomer with which the speaker had just been dealing, and he showed in a very practical way the wide applicability of mathematics as a working tool whether in the hands of the scientist or the engineer.

The lecturer finally considered the possible structure and location of certain nebulae which have been made the subject of much study in recent years. These may be distant galaxies equal in magnitude to the

galaxy of which the sun is a member. As the age of star clusters, as clusters, within our own galaxy may be measured in thousands of millions of years, it may become possible to estimate the age of the galaxy itself in enormously magnified time units in the same sense in which we measure the distances of the stars in terms of light years rather than in terms of our usual standards of length. And, finally, we may pass from the contemplation of the age and extent of our galaxy to that of the age and extent of these great aggregates of galaxies, or super-galaxies, which are by no means beyond the scope of the human mind.

The 131st meeting of the Academy was held at the Assembly Hall of the Cosmos Club, the evening of Tuesday, February 18, 1919. Prof. ROBERT F. GRIGGS, of the Ohio State University, Director of the National Geographic Society Katmai Expeditions, delivered an address on *Katmai and the Ten Thousand Smokes*. The lecture, which was profusely illustrated by lantern slides, reviewed the more general features of this remarkable region, which have been made familiar through the very interesting series of illustrated articles published by the speaker in the National Geographic Magazine, and dealt also with some of the more technical aspects of the subject as discussed in several recent papers published in Volume 19 of the Ohio Journal of Science, under the titles, *The recovery of vegetation at Kodiak* (pp. 1–58), *Are the Ten Thousand Smokes real volcanoes?* (pp. 97–116), *The great hot mud flow of the Valley of Ten Thousand Smokes* (pp. 117–142), *The character of the eruption as indicated by its effect on nearby vegetation* (pp. 173–209).

The 132d meeting of the Academy was held jointly with the Philosophical Society of Washington at the Assembly Hall of the Cosmos Club, the evening of Saturday, March 15, 1919. Dr. H. D. CURTIS, of the Lick Observatory, Mount Hamilton, California, delivered an illustrated address on *Modern theories of the spiral nebulae*. This lecture has subsequently been published in the JOURNAL (9: 217–227. April 19, 1919).

The 133rd meeting of the Academy was held at the Assembly Hall of the Cosmos Club, the evening of Thursday, March 20, 1919. Lieut. Col. JOHN R. MURLIN, U. S. A., Director of the Division of Food and Nutrition, Sanitary Corps, U. S. Army, delivered an illustrated address on *Food efficiency in the United States Army*. "The United States, in conjunction with her Allies, has waged war effectively. Many people are concerned to know also whether the war has been conducted *efficiently*, which is a very different matter. It may be safely said that in one respect at least we have done far better than in any previous war, *viz.* in the nutritional care of the soldier.

"Army regulations lay a clear responsibility for the character of the food and quality of the cooking upon the Medical Department. It has always been a routine matter of inspection by medical officers to pass upon the sanitation, including the character of food and quality of cooking, of the mess. Feeling this responsibility, in view of the

rapid expansion of the army Surgeon General William C. Gorgas organized in his office, in August, 1917, a Division of Food and Nutrition. This continued as an independent division until after the signing of the armistice. This Division commissioned and trained 113 officers who made nutritional surveys of all the large camps in this country and 40 of them were sent to France to be assigned one to each division of combatant troops as nutrition officers. Just before the signing of the armistice a request was received that all subsequent divisions should have nutrition officers assigned them from this side. After the nutritional surveys had been completed nutrition officers were stationed, one in each camp, to act as inspectors and advisors on all food matters, chiefly on matters relating to the proper construction of menus and the proper use and conservation of food. In short, the function was what might be termed that of food engineers.

"The nutritional surveys have shown for the first time what is the actual average consumption of food by healthy soldiers kept at hard work throughout the training period. The average consumption for 427 messes scattered throughout all the training camps in the United States and covering all periods of the year is 3633 calories per man per day, distributed as follows: 14 per cent protein, 31 per cent fat, and 55 per cent carbohydrate. In addition to this the average soldier in something over 300 surveys has consumed 365 calories, which he purchased from the canteen. This added to the consumption from the mess makes a total food consumption of 3998 calories. The surveys also showed for the first time a definite seasonal variation in food consumption. They showed likewise a progressive and consistent improvement in food conservation up to the signing of the armistice, at which time discipline and morale suffered a distinct diminution resulting in greater waste of food.

"In comparison with the garrison ration authorized in army regulations as the basis for the subsistence of one man for one day, the amount of food actually consumed leaves a margin of fully 20 per cent. The Division of Food and Nutrition recommended a reduction of this margin to 10 per cent, but the recommendation was not adopted by the General Staff.

"The surveys have demonstrated marked physical improvement in the soldiers during the period of training. For example, at Camp Devens the 303d Field Artillery exhibited in a period of five months an average gain in weight of more than six pounds, due to "muscling up." There was also a distinct gain in height, much of which no doubt was due to "straightening up."

"The lecture was illustrated by lantern slides and motion pictures, showing methods of food inspection, methods of serving, of dishwashing, of baking and handling of bread, and of feeding sick and wounded soldiers." (*Author's abstract.*)

WILLIAM R. MAXON, *Recording Secretary.*

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 813th meeting was held at the Cosmos Club, February 1, 1919; President HUMPHREYS in the chair; 68 persons present. The minutes of the 812th meeting were read in abstract and approved.

Major FRED E. WRIGHT presented the first paper on *War time development of the optical industry.* (No abstract).

The second paper was by Mr. E. D. WILLIAMSON on *Temperature and strain distribution in glass.* The paper was illustrated by lantern slides.

Abstract: When a temperature gradient is set up in a solid, stresses result, owing to the unequal expansions of the various parts. The same is true of a viscous liquid, except that in the case of the latter there is a slow yield to the forces and in time the stresses and strains would vanish for that temperature distribution. At any time, then, there is a specific temperature distribution (dependent on the previous heat treatment) for any piece of glass, under which the glass is unstressed. If this temperature distribution be known the stresses produced when the temperature becomes equal throughout the mass can be calculated from elasticity data.

The paper dealt in detail (1) with the nature of the temperature gradients produced by uniform heating or cooling, at a constant rate, of the surface of solids of the following shapes, *viz*, slab, square rod, cylindrical rod, brick, short cylinder, and sphere; and (2) with the stresses set up in solids whose unstressed temperature distribution is that considered in (1). The stress relations were treated in full for the case of a sphere only.

The next paper was by Messrs. A. Q. TOOL and J. VALASEK on *Some characteristics of optical glasses in the annealing range.* This paper was presented by Mr. TOOL and was illustrated by lantern slides.

Abstract: In order to carry out the process of annealing glass efficiently a thorough knowledge of its various properties in the range of temperatures employed is necessary. In this respect the viscosity of the glass is very important, since any information as to its magnitude and variation with the temperature enables one to calculate the time required for the stresses to relax to any predetermined ratio of their initial value and to draw some conclusions as to the best cooling procedure. The term annealing temperature is used here to designate that constant and uniform temperature, consistent with the most efficient annealing procedure, at which the glass should be held while the stresses disappear. This temperature is determined by a study of the relaxation of stresses in a sample of glass at various temperatures. The two types of methods which have been employed for this purpose involve either a determination of the rate of decrease of internal forces by means of the double refraction exhibited, or the measurement of the rate of deformation of a suitable piece of glass under externally applied forces.

A form of the first type, often recommended for practical testing, was tried after some modification. Briefly, it consisted of heating a glass

cylinder with polished ends at a constant rate between crossed nicols and noting the temperature at which the double refraction began sensibly to diminish and also the temperature at which it vanished rapidly. It was found by experiment that the lower temperature gave good results as an annealing temperature and that the glass could be held at the higher temperature for a reasonable time without serious deformation.

Maxwell's "relaxation time" for the internal stresses in unannealed glass was determined at various temperatures by measuring the constants of the elliptical polarization by means of a modified Stokes elliptic analyzer.

In measurements of the second type, the stretching and bending of glass strips under load was employed, following Twyman and others.

The results indicated that the relaxation time not only depends on the temperature and the kind of glass, but also that larger stresses will relax more quickly. Stretching and bending gave practically the same results but the optical method gave considerably larger values, the discrepancy varying with the kind of glass. For large and equal stresses there was a better agreement.

Twyman's empirical exponential law for the change in the relaxation time with temperature holds quite closely for small temperature ranges. The constant in the exponential term appears to increase with the temperature and vary considerably with the glass. The most efficient method of cooling seems to be such that the rate increases exponentially according to the same law, as long as the stresses in the glass remain at all times below the breaking stress.

A phenomenon which may be of considerable importance in annealing and other processes in glass manufacture as well, was an apparent endothermic transformation found when careful heating curves were taken by means of differential thermocouple.

Mr. C. G. Peters has shown that this effect is accompanied by a very marked increase in the thermal expansion coefficient. This would appear to make it advisable to carry out the annealing below the region of this effect. It occurs in general, immediately following the temperature at which double refraction begins sensibly to diminish. It was found in all the optical glasses tested as well as many others.

Lately Mr. M. So has published similar results for some Japanese and other glasses. He failed however to observe a corresponding effect on cooling which had been the first indication of it observed in this laboratory.

A very plausible explanation would appear to be that the rapid heating disturbs the equilibrium between the components existing in the glass, which, in connection with the rapid decrease of viscosity, tends to reestablish itself with corresponding rapidity causing the thermal effects observed.

Discussion: Major WRIGHT stated that the temperature ranges cited by the authors agreed very closely with those found by him. Mr.

LITTLETON spoke on some of the characteristics of Pyrex glass. The paper was also discussed by Messrs. WHITE and PETERS.

The last paper of the evening was by Mr. L. H. ADAMS on *The annealing of glass.*

The paper was illustrated by lantern slides.

Abstract: The class of materials known as glasses is peculiar in many ways. At ordinary temperatures glasses are as hard, rigid, and elastic as ordinary solids, but when heated they gradually become softer and change without discontinuity into viscous and finally into thin liquids. During cooling the reverse process takes place and there is therefore a long range of temperature in which so-called solidification takes place. It is primarily due to this fact that cooled objects of glass acquire internal strain.

Optical glass must be free from strain, first because if the strain is excessive the glass may fracture when handled or when heated again, and second because the surfaces of a badly annealed lens or prism may gradually warp and thus impair the definition of the finished instrument.

For the practical annealing of optical glass it is sufficient to know for several temperatures the time required for the removal of strain. The necessary measurements have been made for nine kinds of optical glass and the application of the results to the annealing of optical glass in the factories has met with entire success.

Discussion: Mr. WHITE inquired if the method of annealing glass by holding it at a given temperature for a rather long time and then subjecting it to sudden cooling had not been introduced by Williamson and Wright. Mr. WILLIAMSON stated that his use of the method was due to the fact that it could be easily carried out by ordinary glass-workers and with the available furnace equipment. Major WRIGHT stated that the method had been rather unconsciously adopted.

The 815th meeting was held at the Cosmos Club, March 1, 1919; President HUMPHREYS in the chair; 30 persons present. The minutes of the 814th meeting were read in abstract and approved.

Mr. W. P. WHITE presented the first paper on *Change of state in solids—facts and theories.* The paper was illustrated by lantern slides.

Abstract: Changes of state in the solid, that is, changes of crystalline form, are from thermodynamic necessity like the change of state solid-liquid, that is, melting, in that the production of the high temperature form is always accompanied by an absorption of heat, but they show great variety in many phenomena. Nearly every law or rule which has been set up for such transformations has been shown to be abundantly violated. For example, in cases where of two forms both can be cooled to absolute zero, it is demonstrable that the high temperature form must at the temperature of inversion have the greater entropy, which involves that at some portion of the temperature scale below that point its specific heat must be higher, and the supposition is natural that the specific heat would be higher at all temperatures. In 40 per

cent of the investigated cases, however, the high temperature form at the inversion temperature has a lower specific heat; that is, its specific heat after being higher reverses and becomes lower again.

So, also, excellent atomic theories have accounted for the fact that of two forms the one of larger volume has the larger specific heat, but it turns out that in 70 per cent of the investigated cases it is the more dense form which has the larger specific heat. Again, it is a general rule that as bodies are compressed their power to resist further compression increases, but out of 27 cases of inversion 17 had the form of smaller volume more compressible. Finally, the high temperature form, being produced by an absorption of heat, that is, by doing work against attractive forces, would be expected to have a larger volume. In 25 per cent of the known cases even this expectation is not realized.

In order to explain this last surprising circumstance, Bridgman (whose experimental work has furnished the above results) points out that we must suppose atoms to have shapes other than spherical with centers of attraction situated elsewhere than in the center, but he points out that the nonspherical form means merely that the centers of repulsion (which by determining the resistance of the atom to penetration by other atoms determine what we think of as its boundary), must be distributed in a way which is very far from spherical symmetry. It is idle to assign definite patterns to these distributions of centers of force, but the fact is clear that while with atoms in any given arrangement a slight compression involves the doing of work against the repulsive forces, the rearrangement of atoms involved in a change of state may produce changes of volume to which the change in energy bears no correspondence. There is merely a 3 to 1 probability that they will correspond in sign. About one solid substance in three is estimated to show changes in crystalline form.

In some work done by the speaker it turned out that the quartz inversion, which has been known to be preceded by an abnormally large and progressive change in volume and various crystalline properties, also manifests an absorption of heat which is quite out of relation to the work done in expansion, unless we suppose that the compressibility is extraordinarily modified. Hence all the phenomena of this change, which is detectable over a range of 500 degrees or more, have the characteristics of a change of state, except that we do not appear to have two different forms in equilibrium at the same temperature, as we do in most other cases. The promptness of these changes affords a remarkable contrast to other changes of state between quartz and other forms of silica, which are unusually sluggish.

Discussion: This paper was discussed by Messrs. WILLIAMSON, SOSMAN, BICHOWSKY, and HUMPHREYS.

Mr. F. B. SILSBEE then presented a paper on *Some peculiarities of electrical conduction in porcelain.* This paper was illustrated by lantern slides, and has been published in this JOURNAL (**9**: 252).

Discussion: Mr. L. J. BRIGGS asked if electrodes other than those of molten solder had been used. Mr. WHITE inquired concerning the ef-

fect, on the "polarization" of increasing the thickness of the porcelain plates, also whether a saturation test could not be utilized to determine the possible functioning of electrons.

In reply, Mr. SILSBEE stated that platinum electrodes had also been used but with similar results; that no experiments had been made to test the effect of increasing the thickness of the porcelain plates; and that he did not think the saturation test could be made owing to the introduction of thermal complications due to actual heating of the porcelain, by the currents even before the currents ceased to be proportional to the applied potential-differences.

Mr. SOSMAN suggested the possibility of finding a solution of the problem in a study of the glass in the porcelain. The paper was also discussed by Messrs. WILLIAMSON and BICHOWSKY. Mr. AGNEW commented on the great variety of causes given for the failure of airplane engines, and the frequent lack of consistency between explanation and evidence.

The 817th meeting was held at the Cosmos Club, March 29, 1919; President HUMPHREYS in the chair; 80 persons present. Minutes of the 815th and 816th meetings were read in abstract and approved.

The first paper was persented by Mr. W. R. GREGG on *Trans-Atlantic flight from the meteorologist's point of view*, and was illustrated by lantern slides.

Abstract Inasmuch as weather conditions constitute a vital factor in the success or failure of trans-Atlantic flight, it is essential that these conditions be known as accurately as possible, in order that an aviator may know beforehand his "margin of safety" and may make his plans accordingly. The purpose of the paper is, therefore, briefly to present (1) a statement giving the present state of our knowledge relative to average surface meteorological conditions over the portions of the North Atlantic between Newfoundland and Ireland and between Newfoundland and Portugal via the Azores; (2) a similar statement as to free air conditions, particularly at altitudes of 500 to 1000 meters; and (3) an analysis showing the assistance that may be rendered by the winds, providing an aviator, with this in mind, carefully selects his time for flight.

Under the first and second headings conditions of temperature, humidity, cloudiness, precipitation, fog, pressure and winds are briefly summarized, this summary being based upon such few observations as have been made at sea and to a greater extent upon those made over adjacent land areas. In the application of the latter due consideration has been given to the essential differences between marine and continental climates, particularly with reference to free air conditions.

In the third part of the paper the necessity of having observations at the time of flight is pointed out. If such observations are available and if the airspeed of the machine is known, the meteorologist is able quickly to indicate the successive directions toward which the airplane should be headed, in order that it may keep to any desired course;

also, the resultant speed along that course, or the total time required for making a flight.

Conditions of pressure and wind that would be favorable for eastward and westward flights along the two routes are briefly discussed, and tables are given showing the average number of days, monthly, seasonal and annual, that are favorable for such flights. The figures in these tables are based upon an examination of daily marine weather maps covering a period of ten years. The results of this study show: (*a*) at an altitude of 500 to 1000 meters conditions are favorable for an eastward trip approximately one-third of the time, the percentage being slightly greater along the northern than along the southern route; (*b*) at greater altitudes the percentage of favorable days materially increases, especially along the northern route; (*c*) for the westward trip the percentage of favorable days is so small as to make trans-Atlantic flight in this direction impracticable until the cruising radius of air-craft is increased to such an extent that they are relatively independent of wind conditions; (*d*) there is little choice as to season, for, although the prevailing westerlies are stronger in winter than in summer, yet, on the other hand, stormy conditions are more prevalent in winter, the net result being about an equal percentage of favorable days in the two seasons. The transition seasons, spring and autumn, show a slightly smaller percentage than do summer and winter. For full publication of this paper see Monthly Weather Review, February, 1919.

Discussion: The paper was discussed by Messrs. BOWIE, AULT, HUMPHREYS, BROOKS, and HAZARD.

Mr. C. F. MARVIN presented the second paper on *The flight of aircraft and the deflective influence of the earth's rotation.* The paper was illustrated by charts.

Abstract: Objects moving freely in a horizontal manner over the earth's surface are deflected constantly to the right in the Northern hemisphere by a force which at airplane speeds, say 40 meters per second, and at latitude 50 degrees, amounts to .447 dynes per gram of moving matter.

The purpose of the paper was to indicate the amount by which an aircraft flying in still air may be carried off any desired course by the action of this small force, especially when a compass is the only guide followed in holding the course.

The speaker showed that a residual or resultant force, in addition to the deflective influence, almost constantly exists in assumed straight-away flying and arises from the reactions between the airplane and the air. The pilot has no knowledge of or control over this force, which, nevertheless, dominates the flight and operates to turn the machine from its course, now to the right, now to the left, in an irregular and entirely accidental manner. Repeated rectifications of the course are necessary, and it was assumed for purpose of quantitative analysis that on the average the pilot rectifies the course every 60 seconds of the flight.

Although the accidental forces dominate the flight and necessitate frequent rectification, nevertheless these tend to average out and their sum to become zero. The same is true of accidental side slipping effect. Therefore the problem resolves itself into finding the displacement by the deflective influence when operating during the interval between rectifications.

It was shown the aggregate effect tended to carry the craft to the right of its course in the Northern Hemisphere by a small angular amount given by the equation,

$$\theta = \frac{360}{86164} t \sin \varphi$$

in which t is the time in seconds between rectifications and φ is the latitude.

The angle θ could be regarded as a compass correction and the error of flight eliminated by steering to the left of any specified course by the angular amount θ, values of which for different latitudes were given varying from over 5 minutes of arc at latitude 20 degrees to nearly 15 minutes at 80 degrees. It was also shown that the linear displacement from course varied as the $\sin^2 \theta$ or nearly as the square of the time between rectifications and in a 10-hours' flight would amount to nearly 5000 meters.

While not a part of the main purpose of the paper, it was pointed out that the equations lead to the deduction that gliding could be prolonged if executed in a right-hand instead of a left-hand turn of large radius. Also, turning to the right when climbing is more efficient than turning to the left.

Following the second paper Mr. L. J. BRIGGS spoke briefly on the application of certain other dynamical principles to the flight of aircraft.

S. J. MAUCHLY, *Recording Secretary.*

BIOLOGICAL SOCIETY OF WASHINGTON

The 595th regular meeting of the Society was held in the Assembly Hall of the Cosmos Club, Saturday, April 5, 1919; called to order at 8 p. m. by President SMITH; 55 persons present. Eight informal communications were presented.

W. P. TAYLOR: The Olympic elk, *Cervus roosevelti*, thought to have been extirpated in Washington State outside of the Olympic Mountains, has recently been reported from the following localities within Pacific County; two bands of 40 each on the Nasel River, one band of about 50 on North River, one band of 25 on the Nemah River, two small bands on the South Fork of Wallapa River, and one small band on the main Wallapa River. There are said to be about 175 animals in all.

A. S. HITCHCOCK: Attention called to two recent botanical publications, and copies of the books exhibited: Prof. J. F. ROCK, *A monographic study of the Hawaiian species of the Lobelioideae*, and Prof. E. D. MERRILL, *Rumphius's Flora Amboinensis.*

H. C. OBERHOLSER: Remarks on ornithological activities during 1918 in which year 26 subspecies and 3 distinct species (one of the latter an extralimital straggler) had been added to the North American avifauna, while 8 forms were removed from the list.

T. S. PALMER: Remarks on the rare New Caledonian bird, kagu, *Rhinochitus jubatus*, but few specimens of which are found in collections, none in the U. S. National Museum, although it is frequently seen in zoological gardens there being at present a specimen living in the collection of the New York Zoological Society.

T. S. PALMER: Remarks on the number of bison in North America thirty years after the first census in 1889. There are at present 7300 individuals of which 4300 are in Canada as against a total of 1091 in 1889. There were born in 1918 1100 calves. The government owns eight herds, embracing 850 animals.

A. WETMORE: Remarks on the shape and size of the pupils of birds, particularly of the black skimmer, *Rynchops niger*, in which the contracted pupil is a vertical slit.

N. DEARBORN: Remarks on the apparent preference by a pair of bluebirds for a newly-painted blue-colored box over an old weather-worn greenish one.

H. SMITH: Exhibition of drawings of the deep-sea fish, *Gargariscus semidentatus*.

The regular program consisted of two communications:

AGNES CHASE: *Oil grasses and their uses in perfumery.* Four grasses, native of the East Indies, furnish essential oils. All belong to the Andropogoneae. *Cymbopogon nardus*, citronella grass, and *C. citratus*, lemon oil grass, are not known in the wild state. They are cultivated throughout the tropics, but on a commercial scale mostly in the East Indies. From 1909 to 1917 experiments were carried on with *C. citratus* by the Department of Agriculture in Florida. It could be grown on sandy pineland at a fair profit. In these two species the sterile plants, cut above the base, are distilled. The oil is used for scenting soap and for adulterating other oils. *Cymbopogon martini*, rusá grass, is not cultivated, but harvested from the wild plants common in India. Only the inflorescence is distilled. Rusá, or palmarosa, oil is used chiefly for adulterating attar of roses. This is the *Andropogon schoenanthus* of pharmacopoeias, but not the real species. *Anatherum zizanioides*, Khus-Khus or Vetiver, is both wild and cultivated, now spread throughout the tropics and grown sparingly in southern Louisiana and southern California. The oil is obtained from the roots. Its volatility is low and it is used as a fixative for other oils. The roots are woven into mats, screens, fans, etc., in India, and are made into perfume powder.

Discussion by Messrs. H. M. SMITH, and A. S. HITCHCOCK.

R. M. ANDERSON: *Recent zoological exploration in the western Arctic.* Dr. Anderson, who was in Washington to attend the organization meeting of the American Society of Mammalogists, gave an account of several years of zoological exploration along the western coast of Arctic America. He described his itinerary and referred to the difficulties of zoological

collecting in the Arctic, calling attention to the limitations of travel during the short summer and the ease of travel in winter. In winter, however, animals of migratory and hibernating habits are not encountered. He described the topography of the territory explored, the distribution of the animal and plant life in it and the migrations of some of the forms. He discussed in particular the muskoxen, the yield of long-fibered wool, and contemplated attempts to domesticate them. Among other interesting discoveries was a spider whose nearest relatives occur on certain mountain summits in the United States. Attention was called to the relatively high summer temperature and the twenty-four-hour period of daylight and to its stimulating effect on plant life and to the fact that Arctic animals have to endure a relatively hot summer climate during part of their year. The collections brought back are being studied by various specialists and the published reports will occupy several octavo volumes. Discussion by Messrs. T. S. PALMER, H. M. SMITH, W. P. TAYLOR, R. M. LIBBEY, E. A. PREBLE, W. B. BELL, and H. C. OBERHOLSER.

M. W. LYON, JR., *Recording Secretary.*

ENTOMOLOGICAL SOCIETY OF WASHINGTON

The 321st meeting of the Society was held in the Auditorium of the Cosmos Club, on April 3, 1919. Thirty-three members and 4 visitors were present. President SASSCER presided.

PROGRAM

GIBSON, EDMUND H.: *Some war-camp insect problems.* This was an informal account of the insect problems which the speaker as a captain in the Sanitary Corps had to contend with at Camp Humphries, Virginia. Captain Gibson spoke of the methods adopted in controlling mosquitoes, flies, and bedbugs, and illustrated his talk by maps, charts, and photographs.

For the control of mosquitoes both drainage and oiling were employed as well as the occasional removal of the floating debris in the small bays along the river front. As a result of the mosquito eradication a well-known malarial district was converted into a section comparatively free from mosquitoes; and as shown by charts of the Public Health Service the camp made the best record of any of the cantonments situated in malarial regions.

Against the flies, traps and the treating of manures with gasoline flame were resorted to. As a result of this work no epidemics of dysentery or typhoid occurred in the camp. Captain Gibson brought out the fact that in the observations on the results of the fly work this camp was the only one in the country in which the various species of flies were considered separately.

A very serious infestation of bedbugs was controlled and the bugs entirely exterminated by two applications of kerosene followed by fumigation with carbon disulphide.

Most of the discussion consisted of questions, Captain Gibson's answers to which are incorporated in the above summary of his remarks.

KOTINSKY, JACOB: *The fundamental factors of insect evolution.* (A translation). This paper was a translation from the Russian of Chetverikov. The author advanced the theory that the development of insects has been from large to small, supporting this idea by paleontological evidence. This was contrasted with the development of mammals, the mammoth forms of which reached their greatest development and died out, the present forms having developed from smaller forms. He found the reason for this contrast in development lines in the difference in the skeleton, the exoskeleton of the insects combined with their small size having protected them from their enemies and permitted the development of the tremendous numbers that exist.

In the discussion that followed it was pointed out by Mr. ROHWER that just as at present it is the largest insects of a region that are collected first and the smaller forms later, so it is with fossil insects. Up to the present most of the fossil forms discovered are large, but that there were minute contemporary insects is shown by the Florissant deposits, from which many very minute forms have been taken. Mr. BUSCK expressed the opinion that in the Lepidoptera the primitive forms are as a rule small. Dr. BAKER commented on the effect of climatic conditions and abundance of food supply in the determination of the sexes of insects, and stated that the size of insects can be reduced by limitation of food supply. Mr. MARLATT suggested that perhaps the different conditions of air, water, and soil in ancient times tended to produce animals of immense size.

R. A. CUSHMAN, *Recording Secretary.*

The U. S. Coast and Geodetic Survey reports the completion of the new outline map of the United States on the Lambert Conformal Conic Projections; scale, 1 : 5,000,000; dimensions, 25 × 39 inches; price, 25 cents. This map is intended merely as a base to which may be added any kind of special information desired. It is based on the same system of projection (the Lambert projection) as that which was employed by the armies of the allied forces in the military operations in France. For an area of the shape and position of the United States, this projection has several marked advantages over the Mercator and the Polyconic projections. Throughout the larger and more important part of the United States, that is, between latitudes $30\frac{1}{2}°$ and 49°, the maximum scale error is only one-half of one per cent. The standard parallels of the map of the United States are latitudes 33° and 45°, and upon these parallels the scale is absolutely true. The scale for any other part of the map, or for any parallel, can be obtained from Special Publication No. 52, page 36, U. S. Coast and Geodetic Survey.

The Office of Drug and Oil Plant Investigations, Bureau of Plant Industry, is installing a laboratory at Arlington Farms to study the technology of fats and vegetable oils, in connection with its projects on oil-yielding crops and utilization of waste.

The Coast and Geodetic Survey steamer *Surveyor* left Norfolk, Virginia, on April 21 en route to the Pacific via the Panama Canal. Deep-sea soundings will be made from off Chesapeake entrance to the Bahamas and from Jamaica across the Caribbean Sea.

The Twelfth Annual Conference of Weights and Measures Officials, composed of delegates from the States and larger cities of the United States, met at the Bureau of Standards on May 21–24, 1919, 27 States being represented. The object of these conferences is to bring about uniform laws and regulations regarding the inspection of commercial weights and measures and also to discuss matters of technique and procedure. Among other results of the Conference was the adoption of a resolution favoring the metric system. Officers elected for the following year were: *President*, S. W. STRATTON, Director of the Bureau of Standards; *First-Vice President*, CHAS. G. JOHNSON, State Superintendent for the State of California; *Second Vice-President*, THURE HANSON, Commissioner of Weights and Measures of Massachusetts; *Secretary*, L. A. FISCHER, of the Bureau of Standards.

Dr. PAUL BARTSCH, of the National Museum, returned in May from a trip to the Florida Keys and the Dry Tortugas, where he has been conducting breeding experiments under the joint auspices of the Smithsonian Institution and the Carnegie Institution of Washington.

Professor L. C. GRATON, of Harvard University, came to Washington in June and expects to spend several months in the Bureau of Internal Revenue of the Treasury Department, in charge of copper mine valuation under the Income Tax Unit of the Bureau.

Mr. C. T. GREENE, of the Bureau of Entomology, has recently been made honorary assistant custodian of Diptera in the Division of Insects of the National Museum and is assisting Dr. ALDRICH in the arrangement of the Museum's collection of Diptera.

Major F. R. MOULTON, formerly of the Ordnance Department, U. S. A., received his discharge from the Army and returned to the University of Chicago in April.

Captain EDWIN H. PAGENHART, U. S. R. (Engineers), has received his discharge from the Army and has returned to the Coast and Geodetic Survey.

Mr. E. A. SCHWARZ and Mr. H. S. BARBER have recently returned from a trip to the Florida Everglades, where they collected many insects, which will be added to the collections of the National Museum. One very interesting Scolytid beetle belonging to a tropical genus has already been described by Mr. Schwarz.

Major SAMUEL A. TUCKER, of the Chemical Warfare Service, and Washington representative of the newly-organized Chemical Foundation which took over enemy-owned patents during the war, closed the Washington office in May and has returned to New York.

Mr. R. J. WIG, formerly of the Bureau of Standards, and chief engineer of the concrete-ship department of the Emergency Fleet Corporation during the war, has resigned from the Fleet Corporation to go into private engineering work at San Diego, California.